## Combination Locks

Combination locks work on a series of flat, round disks that have notches and pegs (one of each, one set per disk) along their circumference. Notches are referred to as "gates". The first tumbler determines the last digit of the combination, and is actually attached to the dial directly. As the dial is turned, the peg of the first tumbler catches on the middle tumbler's peg, dragging it along. As the dial is turned further, the middle tumbler latches on to the peg of the last tumbler, all three turning together. Turning all the tumblers is known as "clearing" the lock, and must be done before attempting to operate the lock. For the lock to open, the gate on each disk must align up with the pawl (breaking arm) of the bolt.

Dialing the first digit of the combination aligns the last tumbler's gate to the pawl. Before dialing the second digit, the dial must be turned one complete turn in the opposite direction (assuming a three tumbler lock, twice for a four digit one). Rotating in the original direction to the last digit will align the first tumbler's gate, and the lock can open. Modern safe combination locks are impossible to crack (literally). Many innovations have given high quality locks this degree of security. Burglars learned to feel the gates and pegs rotate about the lock, allowing them to manipulate the tumblers into their proper position. To combat this, a searted front tumbler was designed to create shallow "false gates". The false gates are difficult to distinguish from the actual gates. To combat this problem, safe crackers would hook up a high speed drill to the dial. This would wear the tumblers edges smooth, eliminating the bothersome shallow gates. Still, despite their security, cheap combination locks are far from foolproof.

## Determining an Unknown Combination

The most common and difficult to open of these small disk tumbler locks are the Master combination padlocks, and they are quit popular. With practice, they CAN be opened. The newer the lock is, though, the more difficult it will be to open at first. If the lock has had a lot of use, such as that on a locker-room door where the shackle gets pulled down and encounters the tumblers while the combination is being dialed, the serrated front tumblers will become smoothed down, allowing easier sensing of the tumblers. So, until you have become good at opening these locks, practice extensively on an old one. Here's how.

### Step One

First, clear the tumblers by engaging all of them. This is done by turning the dial clockwise (sometimes these locks open more easily starting in the opposite direction) three to four times. Now bring your ear close to the lock and gently press the bottom back edge to the bony area just forward of your ear canal opening so that vibrations can be heard and felt.

Slowly turn the dial in the opposite direction. As you turn, you will hear a very light click as each tumbler is picked up by the previous tumbler. This is the sound of the pickup pegs on each disk as they engage each other. Clear the tumblers again in a clockwise manner and proceed to step two.

### Step Two

After you have cleared the tumblers, apply an upward pressure on the shackle of the padlock. Keeping your ear on the lock, try to hear the tumblers as they rub across the pawl; keep the dial rotating in a clockwise direction.

You will hear two types of clicks, each with a subtle difference in pitch. The shallow, higher pitched clicks are the sound of the false gates on the first disk tumbler. Do not let them fool you-the real gates sound hollow and empty, almost nonexistent.

When you feel a greater than normal relief in the shackle once every full turn, this is the gate of the first tumbler (last number dialed). This tumbler is connected directly to the dial as mentioned earlier. Ignore that sound for now. When you have aligned the other two tumblers, the last tumbler's sound will be drowned out by the sound of the shackle popping open.

## Step Three

While continuing in a clockwise direction with the dial, listen carefully for the slight hollow sound of either one of the first two tumblers. Note on the dial face where these sounds are by either memorizing them or writing them down. Make certain that you do not take note of the driving tumbler (last number dialed). If you hear and feel only one hollow click (sounds like "dumpf"), chances are that the first number could be the same as the last one.

You should have two numbers now. Let us say one of them is 12 and the other is 26. Clear the tumblers again just to be safe and stop at the number 12. Go counterclockwise one complete turn from 12. Continue until there is another "dumpf" sound. After the complete turn pass 12, if you feel and hear a louder than normal sound of a tumbler rubbing on the pawl, the first tumbler is properly aligned and the second tumbler is taking the brunt of the force from the shackle-you are on the right track. When the second tumbler has aligned in this case, you will feel a definite resistance with the last turn of the dial going clockwise. The final turn will automatically open the shackle of the lock. If none of these symptoms are evident, try starting with the number of the combination, 26, in the same way.

## Step Four

If the lock still does not open, don't give up. Try searching for a different first number. Give it a good thirty or forty minute try. If you play with it long enough, it will eventually open. The more practice you have under your belt, the quicker you will be able to open these padlocks in the future.

Using a stethoscope to increase audibility of the clicks is not out of the question when working on disk tumbler locks, though usually not needed for padlocks. A miniature wide-audio-range electronic stethoscope with a magnetic base for coupling a piezoelectric-type microphone is ideal for getting to know the tumblers better.